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Hospital revascularisation capability and quality of care after an acute coronary syndrome in Switzerland

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Summary

BACKGROUND: Patients with acute coronary syndrome (ACS) transferred to regional nonacademic hospitals after percutaneous coronary intervention (PCI) may receive fewer preventive interventions than patients who remain in university hospitals. We aimed at comparing hospitals with and without PCI facilities regarding guidelines-recommended secondary prevention interventions after an ACS.
METHODS: We studied patients with ACS admitted to a university hospital with PCI facilities in Switzerland, and either transferred within 48 hours to regional nonacademic hospitals without PCI facilities or directly discharged from the university hospital. We measured prescription rates of evidence-based recommended therapies after ACS including reasons for nonprescription of aspirin, statins, β-blockers, angiotensin converting-enzyme inhibitors (ACEI) / angiotensin II receptor blockers (ARB), along with cardiac rehabilitation attendance and delivery of a smoking cessation intervention.
RESULTS: Overall, 720 patients with ACS were enrolled; 541 (75.1%) were discharged from the hospital with PCI facilities, 179 (24.9%) were transferred to hospitals without PCI facilities. Concomitant prescription of aspirin, β-blockers, ACEI/ARB and statins at discharge was similar in hospitals with and without PCI facilities, reaching 83.9% and 85.5%, respectively ($p = 0.62$). Attendance at cardiac rehabilitation reached 55.5% for the hospital with PCI facilities and 65.7% for hospitals without PCI facilities ($p = 0.02$). In-hospital smoking cessation interventions were delivered to 70.8% patients exclusively at the hospital with PCI facilities.
CONCLUSION: Quality of care for patients with ACS discharged from hospitals without PCI facilities was similar to that of patients directly discharged from the hospital with PCI facilities, except for in-hospital smoking cessation counselling and cardiac rehabilitation attendance.

Key words: *acute coronary syndrome; quality of care; clinical guidelines; percutaneous coronary intervention; secondary prevention; cardiac rehabilitation*

Introduction

Compared with university hospitals, smaller regional nonacademic hospitals might be prone to low quality of care, particularly regarding appropriate treatment prescribed at discharge [1]. Clinical guidelines for best-practice management of acute coronary syndrome (ACS) recommend the prescription of antiplatelet drugs, statins, angiotensin converting enzyme inhibitors (ACEI) and β-blockers, as well as in-hospital smoking cessation interventions and the organisation of cardiac rehabilitation at discharge [2–5]. Using these guidelines as reference for quality of care, suboptimal management has often been reported with important geographic variation both in the USA and in Europe [6–10]. To explain these geographic variations, studies have highlighted the role of the size and type of hospitals, academic vs nonacademic, or the presence of percutaneous coronary intervention (PCI) facilities [11, 12].
Taking into account reasons for nonprescription, we previously reported quality of care at discharge for patients with ACS in four university hospitals in Switzerland [13]. However, many patients with ACS initially treated in university hospitals with PCI facilities are rapidly transferred to regional nonacademic hospitals without PCI facilities, and very few data exist about the quality of care for patients discharged from these smaller hospitals. We aimed to assess the prescription rate of recommended preventive drugs and interventions after ACS, including reasons for nonprescription, comparing a large university hospital with PCI facilities with regional nonacademic hospitals without PCI facilities in Switzerland.

Methods

Study population

Patients were recruited in a university hospital with PCI facilities, which takes care of patients with ACS from a large part of the French-speaking region of Switzerland. Between September 2009 and March 2013, patients with an ACS who underwent angiography were enrolled. Patients were part of the large SPUM-ACS cohort study (Special Program University Medicine – Acute Coronary Syndrome) designed to assess long-term prognosis and quality of care after ACS in Switzerland [13, 14]. After admission and initial treatment in the main university hospital, patients living in peripheral geographic areas were transferred within 24–48 hours after PCI to regional nonacademic hospitals without PCI facilities. For each participant, medical records were abstracted, including the discharge letter, laboratory results and all medical procedures, by both trained study nurses and a medical doctor. ACS was defined as presence of symptoms analogous to angina pectoris (dyspnoea, chest pain) accompanied by one of the followings parameters: ST-segment elevation or depression, T inversion or dynamic electrocardiogram modifications, evidence of positive troponin and known coronary heart disease (status after myocardial infarction, bypass surgery or percutaneous transluminal coronary angioplasty), and confirmed on the angiography (International Classification of Disease, 10th Revision [ICD-10] codes I20.0, I21.0–I21.9, and I22.0–I22.9). The study protocol was approved by the local institutional review board and all participants provided written informed consent.

Outcome measures

Prescription rates of recommended secondary prevention medication at discharge were assessed for aspirin, P2Y12 inhibitors (clopidogrel, prasugrel or ticagrelor), statins, β-blockers, and ACEI or angiotensin II receptor blockers (ARB), based on the European Society of Cardiology (ESC) guidelines 2008 and the American College of Cardiology/American Heart Association (ACC/AHA) 2008 performance measures for adults with ST-segment elevation or non-ST-segment elevation myocardial infarction (STEMI/NSTEMI) (supplementary table S1 in appendix) [13]. We included the following prespecified reasons for nonprescription [15] of aspirin: "active bleeding during hospital stay", "coumadin/warfarin prescribed at discharge" and "aspirin allergy". For ACEI/ARB reasons for nonprescription were: "moderate or severe aortic stenosis" and "ACEI and/or ARB allergy"; for β-blockers reasons were: "β-blocker allergy" and "second- or third-degree atrioventricular heart block". For β-blockers, we also included the reason "bradycardia (heart rate <60/min) on day of discharge" given its high reported frequency [15]. For all medications, we included the reason "other reason documented by physician" and "patient refusal". Additionally, for patients transferred to hospitals without PCI facilities after angiography, we further examined the medication prescribed at time of transfer. Performed cardiac rehabilitation rates were assessed from a combination of discharge medical records and self-reported information at the 1-year follow-up visit. If participants were not offered cardiac rehabilitation at discharge from the hospital, but reported having had cardiac rehabilitation at 1-year follow-up, they were considered as having performed cardiac rehabilitation. Participants directly discharged to cardiac rehabilitation from the hospital but not reporting having had cardiac rehabilitation at the 1-year follow-up were considered as having performed cardiac rehabilitation. Participants for whom the cardiac rehabilitation was planned at discharge but not reporting having had cardiac rehabilitation at 1 year were considered as having not performed cardiac rehabilitation. In-hospital smoking cessation counselling was abstracted from the discharge letter for the hospital stay. At the university hospital with PCI facilities, this intervention was performed by a medical doctor trained in motivational interviewing, and ranged from a brief intervention to a complete motivational intervention with enhancement of nicotine replacement therapy, according to the patient's willingness to quit.

Covariates

Patients' health characteristics, including history of diabetes, hypertension, dyslipidaemia, heart failure, stroke, angina pectoris, myocardial infarction, previous cardiac intervention such as PCI or coronary artery bypass graft, and renal insufficiency requiring dialysis were self-reported or abstracted from available medical documents, such as files from the emergency department, or from the general practitioner. Body mass index was defined as the weight divided by height squared and based on self-reported weight and height. Smoking status was categorised into active, former and never-smokers. Former smokers were those who had smoked at least one cigarette a day during at least 1 year, and were nonsmokers for more than 1 month before inclusion.

Statistical analysis

Prescription rates of recommended therapies were reported independently for each drug, as well as after grouping the concomitant use of aspirin, β-blockers, ACEI or ARB, and statins into one variable. The quality of the data was strong with few missing data (<5%), equally distributed among both groups according to presence of PCI facilities, except for the variable left ventricular ejection fraction (LVEF). Available data only were analysed. Bivariate analyses were performed using χ^2 tests and Fischer's exact test to compare frequencies between patients discharged from hospitals with and without PCI facilities. All p-values <0.05 were considered statistically significant. Analyses were performed using Stata version 13 (StataCorp, College Station, Texas, USA).

Results

Out of the 720 patients with ACS who underwent angiography and were enrolled in the study, 541 (75.1%) were discharged home directly from the university hospital, and 179 (24.9%) were transferred after PCI to regional nonacademic hospitals without PCI facilities. The mean age of patients with ACS was 63.4 (standard deviation [SD] 12.6) years, 77.5% were men, 57.2% had hypertension, 20.0% had pre-existing diabetes and 39.0% were active smokers. Participants discharged from the university hospital with PCI facilities were more likely to have dyslipidaemia, hypertension, diabetes, and non-ST-segment elevation myocardial infarction (NSTEMI) than those discharged at regional nonacademic hospitals without PCI facilities (table 1).

Taking into account reasons for nonprescription, the prescription rate of evidence-based therapies at discharge, including statins, aspirin, β-blockers, ACEIs or ARBs was similar between the university hospital with PCI facilities and the regional nonacademic hospitals without PCI facilities (83.9 vs 85.5%, p = 0.6) (fig. 1 and table 2). Reasons for not prescribing medication reached 10.1% for β-blockers and 3.6% for ACEI/ARB and are reported in details by drug categories in supplementary table S2 (appendix). Except for one patient, all were discharged with antiplatelet agents, including aspirin and P2Y12 inhibitors for participants with stent implantation, independently of the type of hospital. There was no difference in adherence to drugs when data were stratified according to gender (data not shown). Overall, attendance at cardiac rehabilitation was better in the regional nonacademic hospitals without PCI capability as compared with the university hospital (55.5 vs 65.7%, p = 0.02). Two-thirds of smokers with ACS had in-hospital smoking cessation interventions when hospitalised in the university hospital with PCI facilities, whereas smokers transferred to regional nonacademic hospitals without PCI facilities did not benefit from smoking cessation interventions in the secondary hospitals, but half of them had a first approach in the university hospital with PCI facilities (table 3).

The prescription rates of β-blockers and ACEI or ARB at time of transfer to regional non-academic hospitals without PCI facilities were 83.8% and 77.7%, respectively, and increased to 93.3% for both (p <0.001) at discharge (table 3).

Discussion

We found that rates of evidence-based drug prescription at discharge for patients with ACS hospitalised in a university hospital with PCI facilities and then transferred to a regional nonacademic hospital without PCI facilities were similar to the prescription rates for patients directly discharged from the university hospital. However, in-hospital smoking cessation interventions were exclusively performed at the university hospital with PCI capability, and cardiac rehabilitation was more frequent in patients discharged from regional nonacademic hospitals without PCI facilities.

In Switzerland, quality of care at discharge for patients with ACS has been mostly documented for university hospitals or hospitals with PCI facilities [13, 16]. A recent study, based on a prospective Swiss national registry named AMIS Plus [17], of patients with ACS in 76 hospitals found no difference in 1-year mortality after ACS ac-

Table 1: Baseline characteristics of patients with acute coronary syndrome, according to type of hospital from which they were discharged (n = 720).

	Hospital with PCI facilities n = 541	**Hospital without PCI facilities n = 179**	**p-value**
Age, y	64.0 ± 12.8	61.9 ± 11.9	0.053
Men, n (%)	421 (78.2)	137 (76.5)	0.722
BMI (kg/m^2) ± SD	27.1 ± 4.4	26.7 ± 4.1	0.271
Education level, n (%) (n = 718) *			0.297
Apprenticeship or lower	366 (67.9)	129 (72.1)	
High school or university graduation	173 (32.1)	50 (27.9)	
History of dyslipidaemia, n (%)	388 (71.7)	103 (57.5)	**<0.001**
History of hypertension, n (%)	322 (59.5)	90 (50.3)	**0.030**
History of diabetes, n (%)	118 (21.8)	26 (14.5)	**0.035**
Smoking status, n (%)			0.180
Active	202 (37.3)	79 (44.1)	
Former	174 (32.2)	51 (28.5)	
Never	165 (30.5)	49 (27.4)	
Pre-existing coronary artery disease, n (%) †	151 (27.9)	33 (18.4)	**0.012**
History of CHF, n (%)	18 (3.3)	5 (2.8)	0.725
Renal insufficiency requiring dialysis, n (%)	6 (1.1)	2 (1.1)	0.993
ACS diagnosis, n (%)			**0.003**
STEMI	243 (44.9)	104 (58.1)	
NSTEMI	252 (46.6)	69 (38.5)	
Unstable angina	46 (8.5)	6 (3.4)	
Revascularisation treatment, n (%)			**0.025**
PCI and stenting	392 (72.3)	150 (83.8)	
PCI no stenting	40 (7.4)	10 (5.6)	
CABG	36 (6.7)	2 (1.1)	
Conservative	73 (13.5)	17 (9.5)	

ACS = acute coronary syndrome; BMI = body mass index; CABG = coronary artery bypass graft; CHF = chronic heart failure; NSTEMI = non-ST-elevation myocardial infarction; PCI = percutaneous coronary intervention; SD = standard deviation; STEMI = ST-elevation myocardial infarction; SD = Standard deviation
* Education level: variable based on 718 patients.
† Variable including history of myocardial infarction, PCI and CABG.

cording to the size of hospital [18]. However, this study was based on administrative data, and reasons for nonprescription and in-hospital smoking cessation interventions were not collected. By contrast, hospitals with full interventional capabilities in the USA were associated with better prescription of recommended drugs compared with hospital without PCI facilities [12]. In France, hospitals with PCI facilities when compared with those without PCI facilities have also been associated with higher drug prescription rates at discharge [19]. In our study, rates of drugs prescription did not differ between hospitals with or without PCI facilities and thus provide reassuring confirmation regarding safety and quality of care for patients with ACS discharged from smaller regional nonacademic hospitals not equipped with highly specialised devices. However the comparison of drug prescription rates between our study and others from Europe or the USA is limited by the different organisation of healthcare systems. In Switzerland, hospitals are grouped into geographical healthcare networks, and patients requiring PCI are transferred from hospitals without PCI facilities to the main hospital, able to provide highly specialised care. During the last decade, various quality improvement strategies have been implemented in Switzerland [20], which might also explain the improvement witnessed in quality of care for ACS patients [13].

We found that in regional nonacademic hospitals without PCI facilities, smokers with ACS were discharged without any in-hospital antismoking intervention. This is in contrast with current international guidelines, which consider early counselling for smoking cessation after ACS as a top priority [2–5]. Despite the proven efficacy to reduce mortality [21], underuse of in-hospital smoking cessation interventions is globally reported [22]. This gap in quality of care is probably due to a lack of resources and trained staff available in smaller regional nonacademic hospitals. During the study period at the university hospital with PCI facilities, there was an "on-call" service for smoking cessation, meaning that smoking intervention was used when patients or the medical staff asked for it. Thus, to reduce the gap in quality of care between hospitals with and without PCI fa-

Table 2: Prescription rates of secondary prevention therapies at discharge, according to type of hospital (n = 720).

	Hospital with PCI facilities n = 541 n (%)	**Hospital without PCI facilities n = 179 n (%)**	**p-value**
Concomitant use of aspirin, β-blockers, ACEI or ARB, and statins	454 (83.9)	153 (85.5)	0.620
Aspirin	540 (99.8)	179 (100.0)	0.565
P2Y12 inhibitors (n = 542) *	392 (100.0)	150 (100.0)	1.000
β-blockers	502 (92.8)	167 (93.3)	0.819
ACEI/ARB †	483 (89.3)	167 (93.3)	0.116
LVEF ≥40% (n = 564)	404 (88.6)	99 (91.7)	0.356
LVEF <40% (n = 58)	44 (95.7)	12 (100.0)	0.462
Statins	532 (98.3)	176 (98.3)	0.991
Performed cardiac rehabilitation ‡	281 (55.5)	113 (65.7)	**0.020**
Performed home-based cardiac rehabilitation	90 (16.6)	37 (20.7)	0.220
Smoking intervention for smokers (n = 281)	143 (70.8)	0 (0.0)	NA
Nitrates ¶	84 (15.5)	27 (15.1)	0.887

ACEI = angiotensin converting-enzyme inhibitors; ARB = angiotensin II receptor blockers; LVEF = left-ventricular ejection fraction; PCI = percutaneous coronary intervention
* Prescription of P2Y12 inhibitors according to participants treated with PCI+stent (n = 542).
† LVEF measurement was missing for 98 patients, 39 in patients discharged from hospital with PCI facilities vs 59 in those discharge from hospital without PCI facilities.
‡ There were 42 missing values, equally distributed among both types of hospitals (6.5% vs 3.9%).
¶ Including slow release and on demand nitrates.

Table 3: Prescription rate of secondary prevention therapies at time of transfer to hospital without PCI facilities and at final discharge (n = 179).

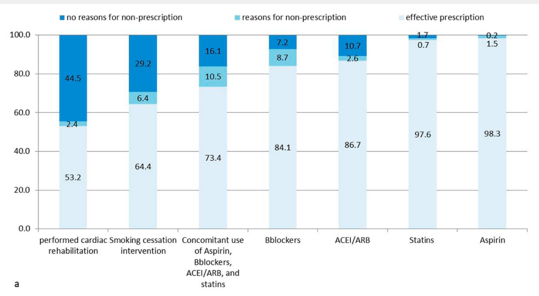
	At transfer to hospital without PCI facilities n = 179 n (%)	**At discharge from hospital without PCI facilities n = 179 n (%)**	**p- value**
Concomitant use of aspirin, β-blockers, ACEI or ARB, and statins	111 (62.0)	153 (85.5)	**<0.001**
Aspirin	179 (100.0)	179 (100.0)	1.000
P2Y12 inhibitors (n = 150) *	150 (100.0)	150 (100.0)	1.000
β-blockers	150 (83.8)	167 (93.3)	**<0.001**
ACEI/ARB	139 (77.7)	167 (93.3)	**<0.001**
LVEF ≥40% (n = 108)	84 (77.8)	99 (91.7)	**<0.001**
LVEF <40% (n = 12)	11 (91.7)	12 (100.0)	0.307
Statins	171 (95.5)	176 (98.3)	0.126
Performed cardiac rehabilitation	NA	113 (65.7)	NA
Smoking intervention	38 (48.1)	0 (0.0)	NA
Nitrates †	15 (8.4)	27 (15.1)	**<0.001**

ACEI = angiotensin converting-enzyme inhibitors; ARB = angiotensin II receptor blockers; LVEF = left ventricular ejection fraction; PCI = percutaneous coronary intervention
* Prescription of P2Y12 inhibitors according to participants treated by PCI + stent (n = 150).
† Including slow release and on demand prescribed nitrates.

cilities in Switzerland, implementing in-hospital smoking cessation counselling in all type of hospitals is necessary, ideally by adopting a systematic intervention for smokers with organised follow-up after discharge [21]. A step has already been taking with a national programme promoting smoking cessation interventions and offering hospital support [23].

Regarding cardiac rehabilitation, our rates of attendance were very high in comparison with current literature [7, 24]. Almost two-thirds of our patients were enrolled in a cardiac rehabilitation programme, with a higher rate observed at hospitals without PCI facilities. Lower education level, older age (>65 years), and pre-existing cardiac diseases or cardiovascular risk factors are commonly reported as being negatively associated with cardiac rehabilitation performance [25], despite its proven efficacy to reduce the risk of recurrence and mortality [25]. Overall, our rates attest a good implementation of cardiac rehabilitation in ACS management in Switzerland, particularly in regional nonacademic hospitals without PCI facilities.

Our study has several limitations. First, our studied population derived from only one university hospital and might not reflect standard care for the entire Swiss population. However, our study sample was derived not from a randomized controlled trial but from an observational study without specific exclusion criteria, as reflected by our balanced proportions of STEMI, NSTEMI and unstable angina, which increases the generalisability of the findings. Second, we did not assess clinical outcome data after hospital discharge to assess quality of care, and further studies should examine this issue. The aim of this study was not to report on the quality of care for all patients in Switzerland, but to determine whether adherence to recommended secondary prevention interventions was high for patients transferred to hospital without PCI facilities after undergoing angiography.



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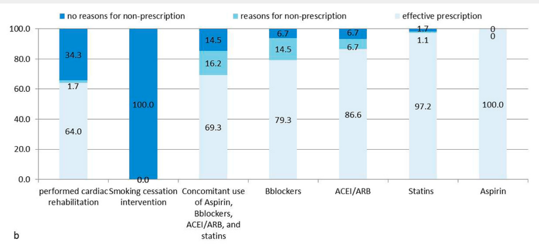

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Figure 1

Secondary prevention therapies and interventions with documented contraindications according to presence of PCI facilities. (a) Hospital with PCI facilities. (b) Hospitals without PCI facilities. ACEI = angiotensin converting-enzyme inhibitors; ARB = angiotensin II receptor blockers; Bblockers = β-blockers; PCI = percutaneous coronary intervention

Conclusion

Taking into account reasons for nonprescription, prescription rates of recommended secondary prevention drugs were similar for patients with ACS discharged from university hospital with PCI facilities or regional nonacademic hospitals without PCI facilities, cardiac rehabilitation attendance was slightly better for patients discharged from hospitals without PCI facilities. To further improve quality of care after ACS, efforts should now be oriented toward the implementation of in-hospital smoking cessation interventions in smaller regional nonacademic hospitals, where a major gap in quality of care remains.

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Appendix

Supplementary tables

Table S1: Degree of evidence according to guidelines.

	ACC/AHA STEMI 2009	**ACC/AHA UA/NSTEMI 2007**	**ESC STEMI 2008**	**ESC NSTEMI 2007**
Aspirin	IA	IA	IA	IA
Dual antiplatelet therapies	IB	IB	IIaC	IA
B-blockers	IA	IB	IA	IA (LVEF <40%)
ACEI/ARB regardless of LVEF	IB	IIaA	IIaA	IIaB
ACEI/ARB and LVEF <40%	IA	IA	IA	IA
Statins and LDL-cholesterol <2.6 mmol/l	IA	IA	IA	IB
Smoking intervention	IB	IB	IB	IB
Cardiac rehabilitation	IB	IB	IB	–

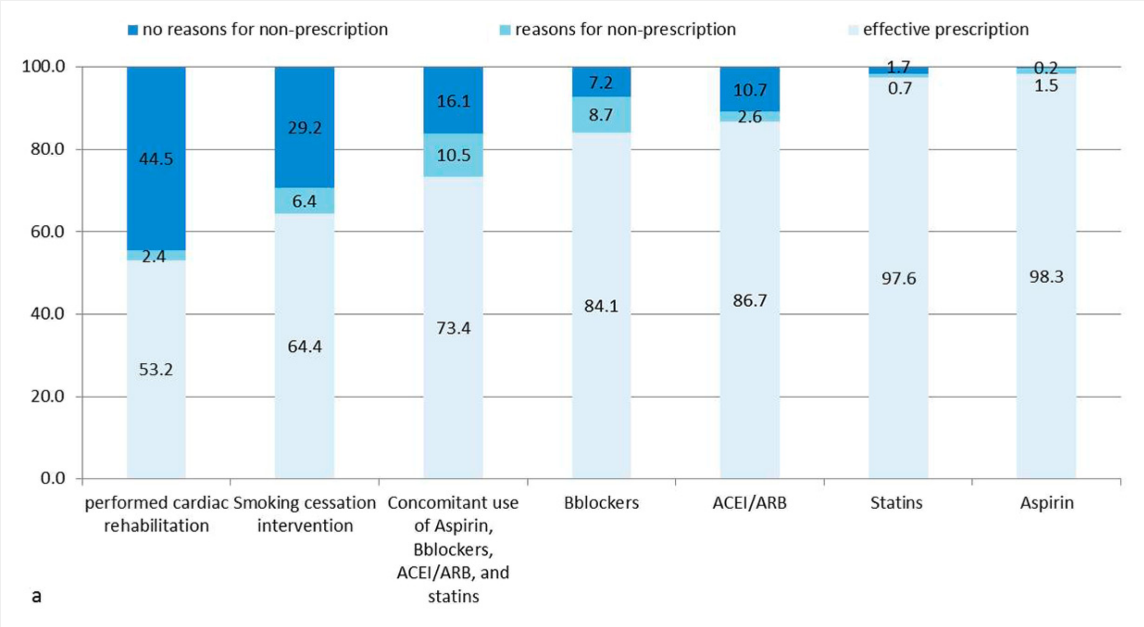
ACC = American College of Cardiology; ACEI = angiotensin converting enzyme inhibitors; AHA = American Heart Association; ARB = angiotensin II receptor blockers; ESC = European Society of Cardiology; LDL = low density lipoprotein; LVEF = left ventricular ejection fraction; NSTEMI = non-ST-elevation myocardial infarction; STEMI = ST-elevation myocardial infarction; UA = unstable angina.

Table S2: Reasons for not prescribing medication or performing cardiovascular preventive interventions.

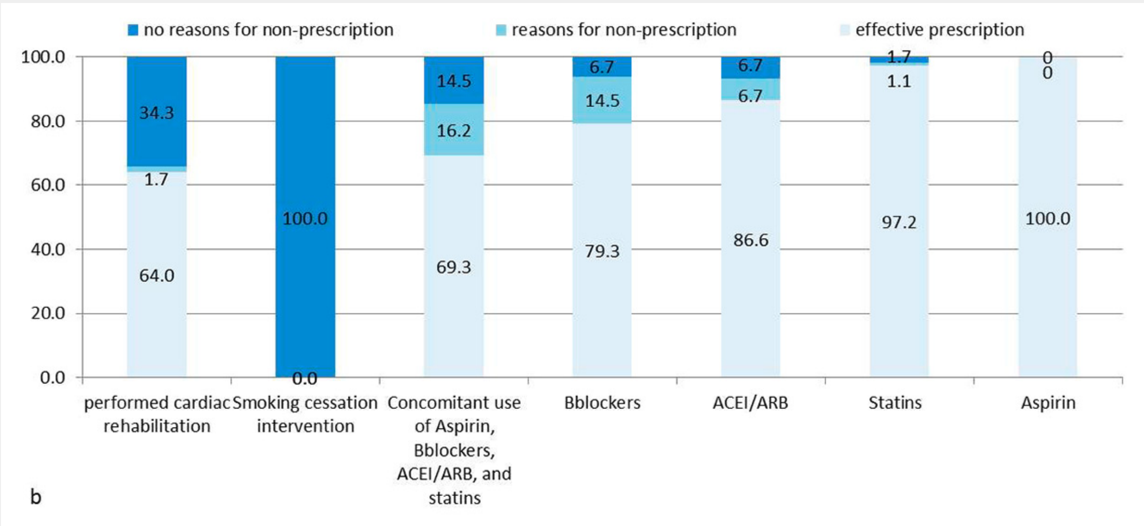
	Hospital with PCI facilities	**Hospital without PCI facilities**
Aspirin		
Side effects	1	NA
Allergy	1	NA
Anticoagulation	6	NA
Statin		
Side effects	4	1
Allergy	1	0
Refusal	0	0
Other cholesterol-lowering drug	0	1
β-blockers		
Side effects	3	0
Haemodynamic compromise	36	21
Atrioventricular blocks	3	0
Delayed prescription	4	2
Not necessary	1	2
ACEI/ARB		
Side effects	0	1
Haemodynamic compromise	9	7
Renal failure	3	4
Delayed prescription	0	0
Not necessary	2	0
Cardiac rehabilitation		
Rehospitalisation planned	3	0
Insurance problem	1	0
Leave without medical approbation	0	1
Health conditions	2	1
Other re-education	3	0
Not necessary	6	1
Refusal	24	4
Smoking intervention		
Ambulatory intervention	2	NA
Already performed recently	1	NA
Refusal	10	NA

ACEI = angiotensin converting-enzyme inhibitors; ARB = angiotensin II receptor blockers; PCI = percutaneous coronary intervention
Side effects includes allergy and intolerance; haemodynamic compromise includes hypotension, bradycardia and right ventricle dysfunction; atrioventricular blocks includes 1st, 2nd, and 3rd degree block

Figures (large format)



a



b

Figure 1

Secondary prevention therapies and interventions with documented contraindications according to presence of PCI facilities. (a) Hospital with PCI facilities. (b) Hospitals without PCI facilities.

ACEI = angiotensin converting-enzyme inhibitors; ARB = angiotensin II receptor blockers; Bblockers = β-blockers; PCI = percutaneous coronary intervention